

Claims

1. A loop antenna unit having a plurality of loop antennas, said antenna unit comprising:

- 5 a first loop antenna to which an electric current is fed; and
a second loop antenna surrounding the first loop antenna to which the electric current is not fed.

2. A loop antenna unit according to claim 1, further comprising:

- 10 a grounded metal member, the first loop antenna and the second loop antenna being connected to the metal member.

3. A loop antenna unit according to claim 2, further comprising:

- 15 a single grounding cable for connecting the first loop antenna and the second loop antenna to the metal member.

4. A loop antenna unit according to claim 2 or 3, further comprising:

- a magnetic member disposed between the first loop antenna and the second loop antenna and the metal member.

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5. A loop antenna unit according to any one of claims 1 to 4, further comprising:

- a first circuit unit including a resonance circuit and a matching circuit connected to the first loop antenna and

- 25 a second circuit unit including a resonance circuit, a matching circuit and a matched load connected to the second loop antenna.

6. A radio communication medium processor comprising:

the loop antenna unit according to any one of claims 1 to 5; and

- 30 a reading and writing part connected to the first loop antenna of the loop antenna unit to carry out at least one of processes of reading and writing information stored in a radio communication medium through the first loop antenna, a signal current from the

reading and writing part being fed only to the first loop antenna.

7. A radio communication medium processor according to claim 6, further comprising:

5 a third loop antenna to which an electric current is not fed, the third loop being arranged adjacently to the loop antenna unit according to any one of the claims 1 to 5.

8. A loop antenna unit including a loop antenna communicating with a radio communication medium and having a pair of opening end parts at both ends and a metal
10 member arranged closely to the loop antenna, wherein the metal member is electrically connected to one of the opening end parts of the loop antenna with a space about $1/200$ to $1/4000$ times as long as the wavelength of a communication frequency.

9. A loop antenna unit according to claim 8, wherein the loop antenna
15 supplies an electric power and transmit data to the radio communication medium in accordance with an electromagnetic induction and obtains receive data from the radio communication medium in accordance with a load variation.

10. A loop antenna unit according to claim 8 or 9, wherein the metal member
20 is arranged substantially in parallel with a main surface of the loop antenna.

11. A loop antenna unit according to any one of claims 8 to 10, wherein a magnetic member is disposed between the loop antenna and the metal member.

25 12. A loop antenna unit according to claim 11, wherein the magnetic member is disposed substantially in parallel with the main surface of the loop antenna.

13. A loop antenna unit according to any one of claims 11 to 12, wherein the magnetic member is disposed with a prescribed space from the loop antenna and from the
30 metal member.

14. A loop antenna unit according to any one of claims 8 to 13, wherein the

area of the metal member is not smaller than about 1.1 times as large as the area of the opening part of the loop antenna.

15. A loop antenna unit according to any one of claims 11 to 14, wherein the
5 magnetic member has a flexibility.

16. A loop antenna unit according to any one of claims 8 to 15, wherein one
of the pair of the opening end parts is electrically connected to the metal member, an
unbalanced type resonance circuit and a ground terminal of a matching circuit, and the
10 other of the pair of the opening end parts is connected to the unbalanced type resonance
circuit and a signal terminal of the matching circuit.

17. A loop antenna unit according to any one of claims 8 to 15, wherein one
of the pair of the opening end parts is connected to a ground terminal of a reading and
15 writing part for reading, writing or reading and writing data of the radio communication
medium, and the other of the pair of the opening end parts is connected to a signal terminal
of the reading and writing part.

18. A loop antenna unit according to any one of claims 8 to 17, wherein in
20 the loop antenna unit, the loop antenna, the magnetic member, the metal member, a first
isolating member disposed between the loop antenna and the magnetic member and a
second isolating member disposed between the magnetic member and the metal member
are laminated.

25 19. A loop antenna unit according to claim 18, wherein the loop antenna is
formed with a pattern conductor provided on an electronic board and the electronic board
is laminated as the loop antenna.

20. A loop antenna unit according to claim 19, wherein the resonance circuit
30 and the matching circuit are formed on the electronic board.

21. A loop antenna unit according to claim 18, wherein the loop antenna unit

is stored in an accommodating case.

22 A loop antenna unit according to any one of claims 8 to 17, wherein the loop antenna unit is accommodated in a housing.

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23. A loop antenna unit according to any one of claims 8 to 22, wherein a plurality of the loop antenna units are arranged linearly, in radial directions or on arrays substantially on the same planes.

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24. A loop antenna unit according to claim 23, wherein the plurality of the loop antenna units include electric current fed loop antenna units to which the signal current is fed and non-electric current fed loop antenna units to which the signal current is not fed.

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25. A radio communication medium processor comprising:
the plurality of the loop antenna units according to any one of claims 8 to 24 and
the reading and writing part for reading, writing or reading and writing the data on
the radio communication medium, wherein the plurality of the loop antenna units include
the electric current fed loop antenna units to which the signal current is fed and the
20 non-electric current fed loop antenna units to which the signal current is not fed.

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26. A radio communication medium processor according to claim 25,
wherein the reading and writing part is connected only to the electric current fed loop
antenna units among the plurality of loop antenna units.